Biological/Chemical Countermeasures RDT&E: at the Department of Homeland Security

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Plans, Programs, & Budgets
Science & Technology

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HSPD-10 lays out an integrated end-to-end biodefense strategy

THREAT AWARENESS	PREVENT & PROTECT	SURVEILLANCE & DETECTION	RESPOND & RECOVER
▪Intel	▪Diplomacy	▪Attack Warning	▪Response Planning
▪Assessments	▪Interdiction	▪Attribution	▪Risk Comm
▪Anticipate future threats	▪Critical Infra Protection		▪Med CM
			▪Mass Cas Care
			▪Decon

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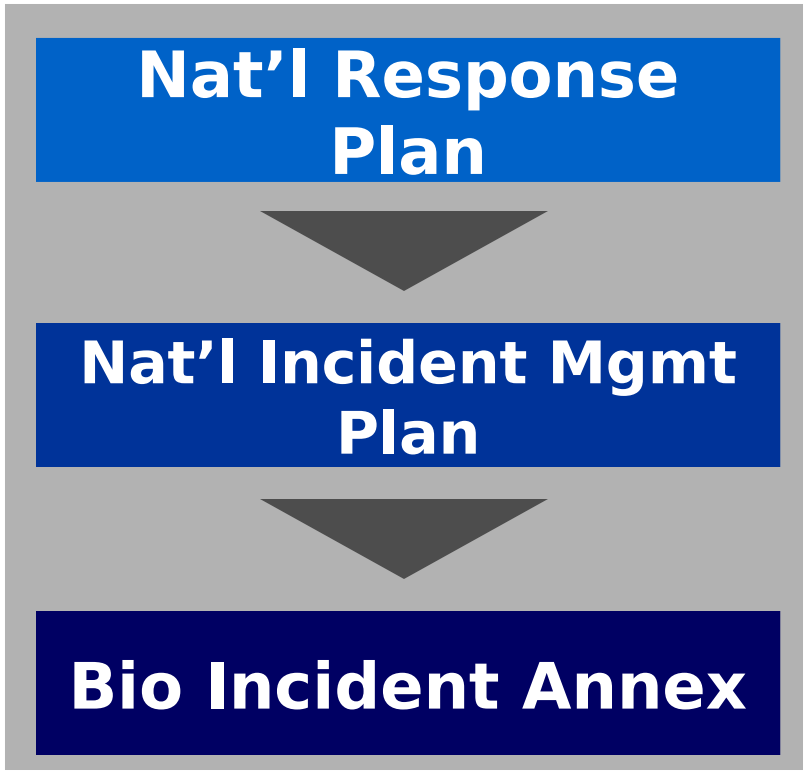
DHS is responsible for coordinating national biodefense efforts



- **DOS**: international aspects
- **DOS, DoD, DoJ, & IC**: proactive prevention
- **HHS:** medical countermeasures & mass casualty care; anticipate future threats
- **USDA**: Ag biosecurity
- **EPA:** decontamination
- **DHS:** assessments; CI protection; attack warning; forensic analysis; response

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as part of this integrated strategy

- **BioShield**: to speed the development of medical countermeasures

- **BioSense**: to develop a national health surveillance system

- **BioWatch**: to develop a national urban environmental monitoring system

- **Integrated Biosurveillance**: to integrate human, animal, plant surveillance with monitoring of the air, food, and water and with intelligence data to provide overall

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Biological Countermeasures Portfolio

Mission Statement

To provide the understanding, technologies, and systems needed to .....protect against.....biological attacks on this nation's population, agriculture or infrastructure.

Objectives

- **Develop an integrated, end-to-end, national biodefense architecture against all biological threats**
- **Provide decision support tools to anticipate, prevent, prepare for and respond to possible events**
- **Support partnering agencies**
- **Coordinate with partnering agencies in intelligence & defense**
- **Conduct RDT&E and transition to deployment needed technologies & systems**

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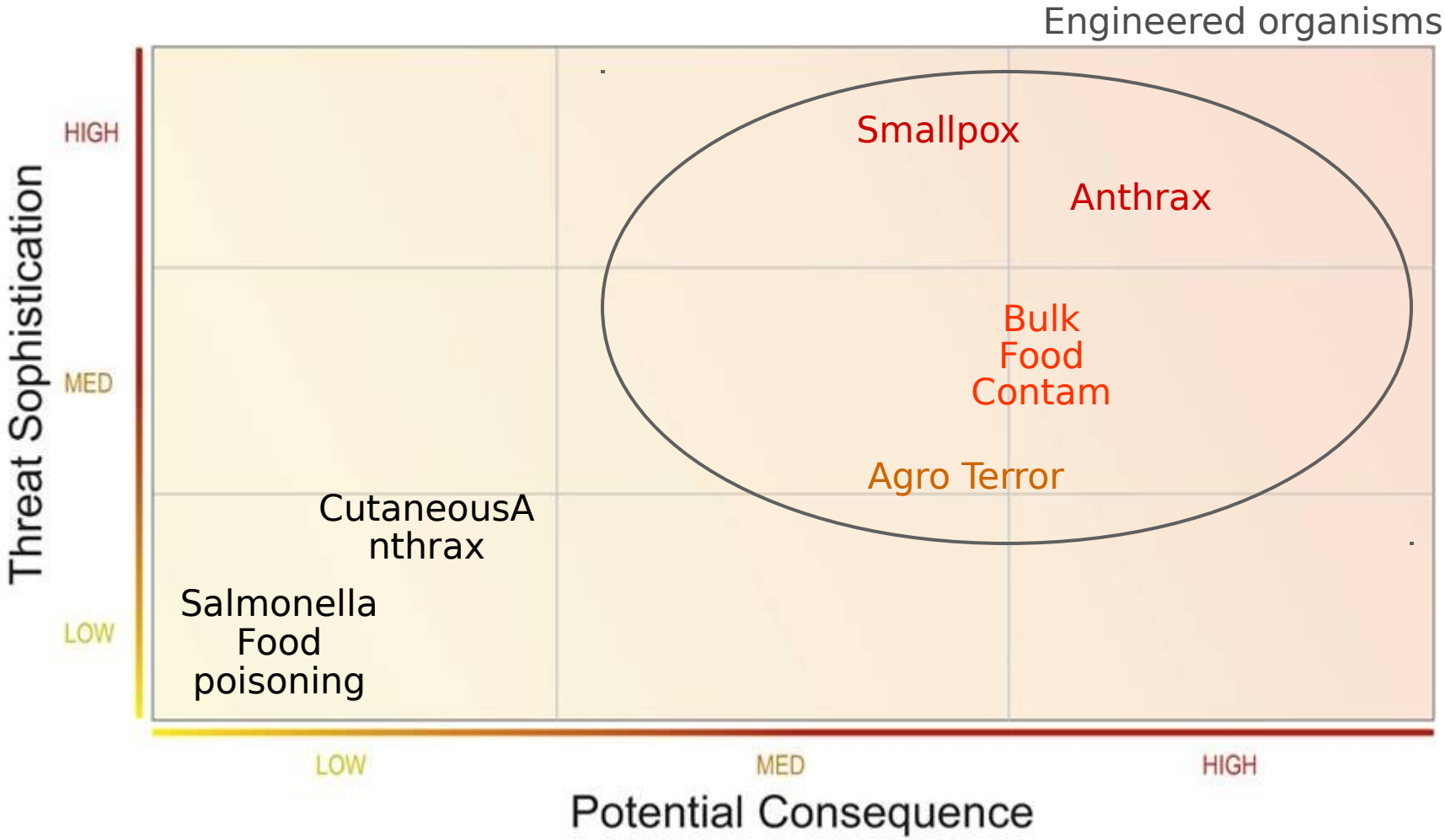
Portfolio's initial emphasis is on high consequence threats



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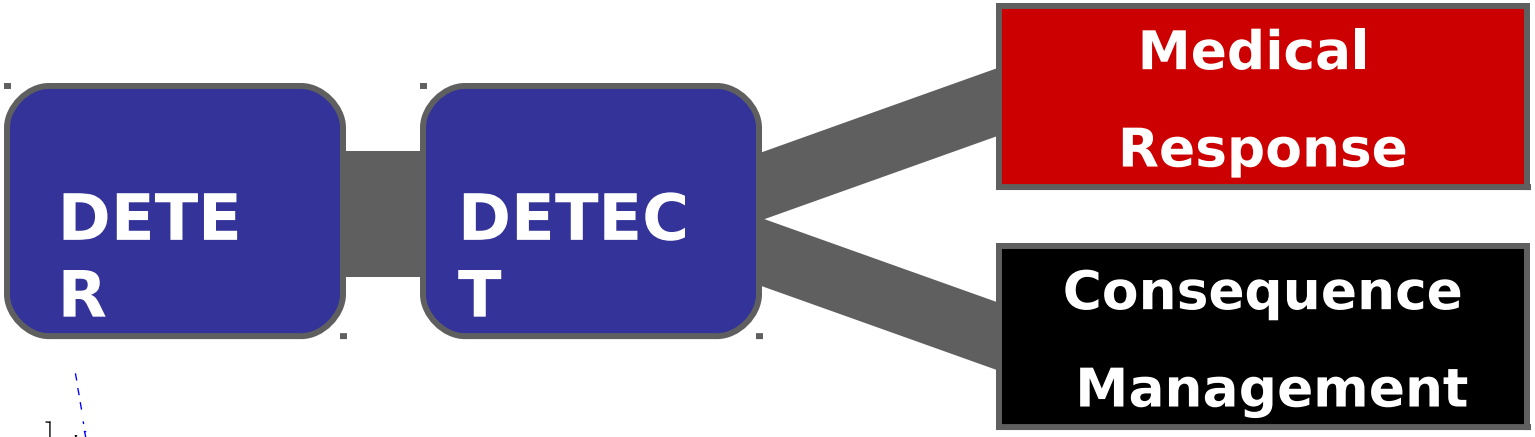
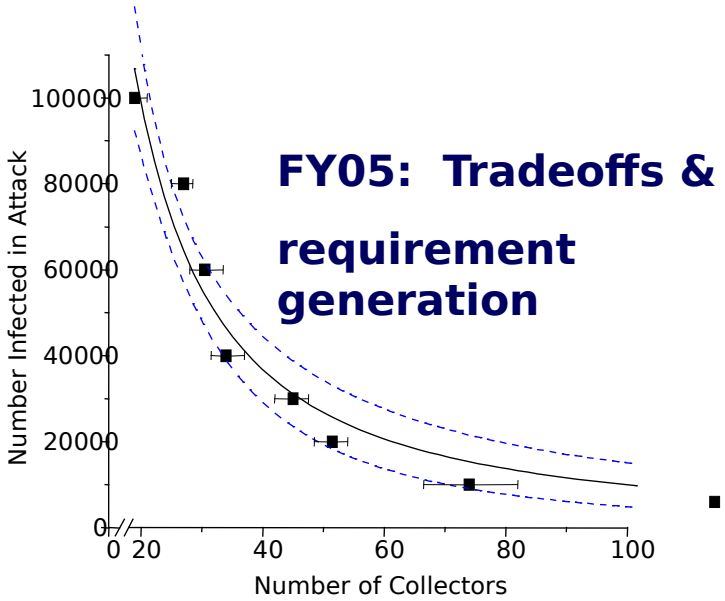
Systems studies guide an integrated end-to-end response





FY05: Tradeoffs & requirement generation

FY06-08: Gaming, simulated testing; red-teaming & training

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NBACC provides scientific support for threat characterization

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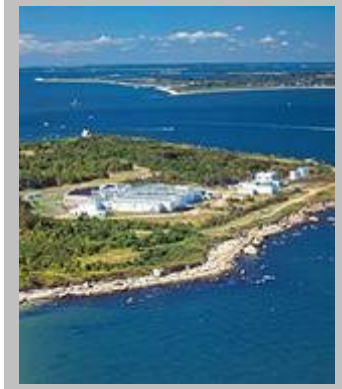
Over the next five years:

- **Threat Characterization Center**
  - Conduct threat & risk assessments
  - Close key gaps in 1st Gen agents
  - Develop a strategy for 2d Gen
- **BioForensics Analysis Center**
  - the designated lead national facility for Bioforensics analysis
- **Knowledge Management Center**
  - Rapidly provide BT

NBACC & Plum Island are part of a joint USDA-DHS agricultural strategy



Net assessment of the FAD threat

- Animals as aerosol generators
- Viral stability/survivability

Development of field portable diagnostics

- National and international validation

Vaccines and therapeutics

- Improve on current vaccines
- Explore vaccine alternatives
- Develop anti-virals

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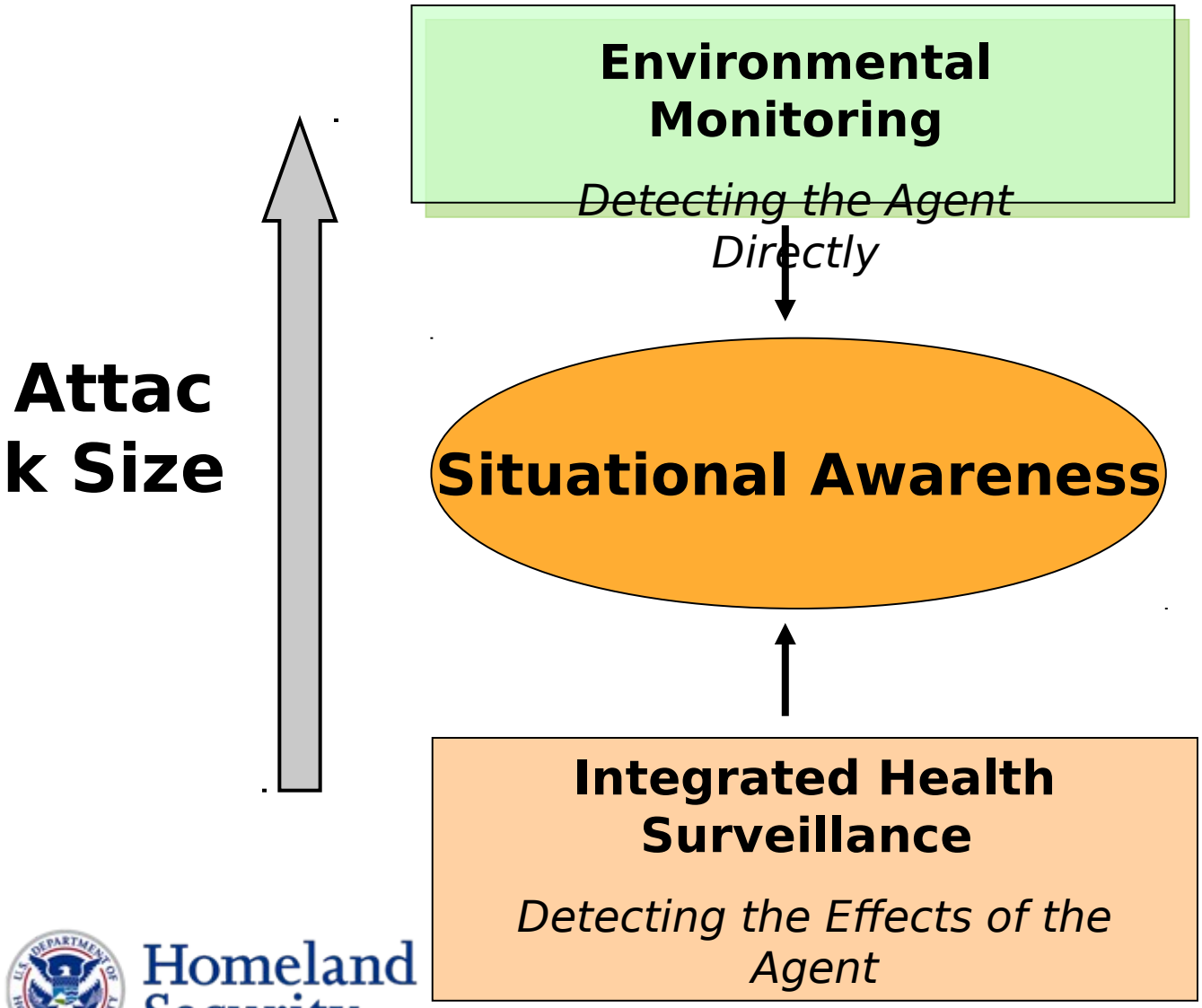
Bio-Warning & Incident Characterization



Defense of Cities Study
The Washington Institute &
Sandia National Laboratories

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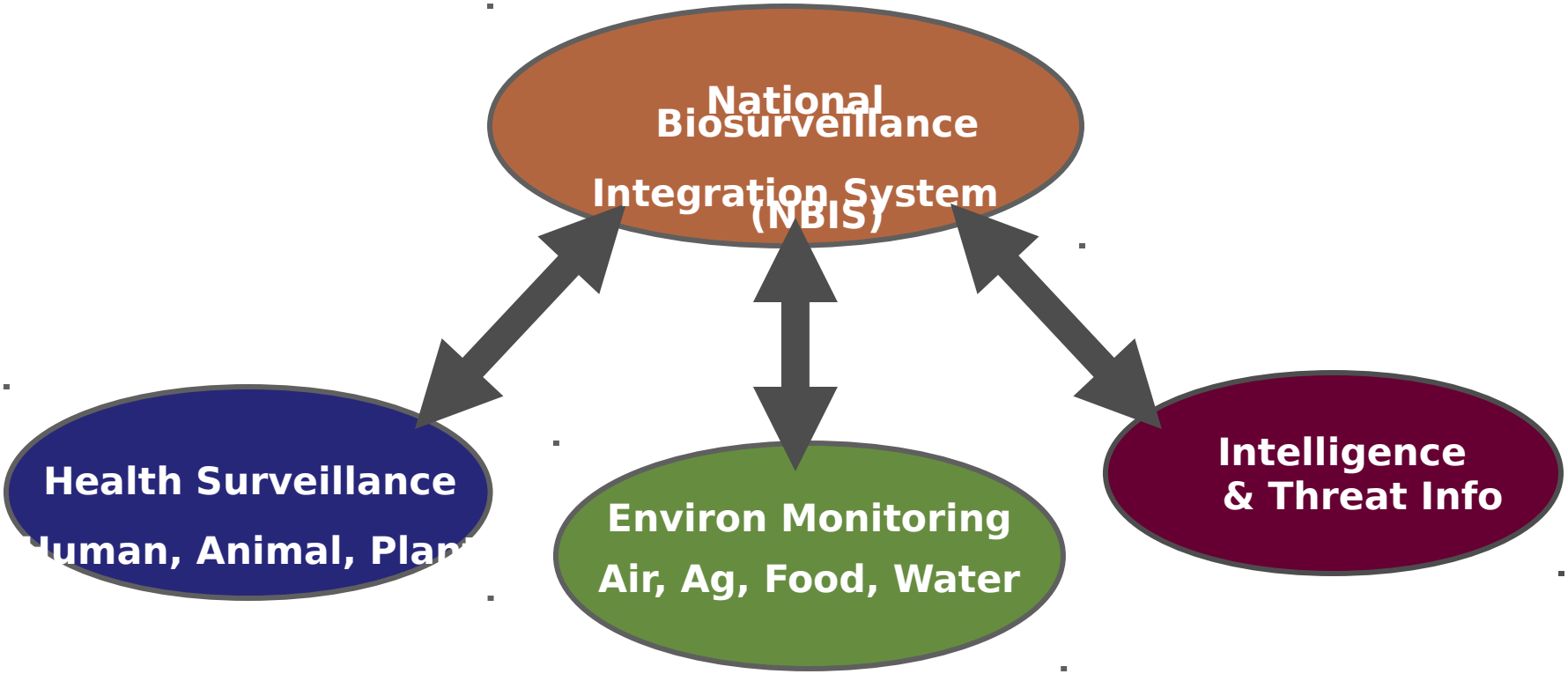
National Biosurveillance Integration capability



- Enable early detection
- Provide situational understanding to guide response
- Share information amongst partners

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Urban Monitoring Systems

- **Wide area monitoring (detect-to-treat)**
  Phase 1 BioWatch (FY03) to increased sampling (FY05-06) to networked sensors (FY09-10)
- **Facility monitoring (detect-to-warn)**
  Simple triggers/low regret responses (FY05-06) to improved detect-to-treat sensors (FY09 - 10) to improved design of new facilities
- **Coordination with other national programs**
  With DoD force protection (BioNet, Guardian), with USPS Biohazard Detection System, with EPA and DARPA building protection programs

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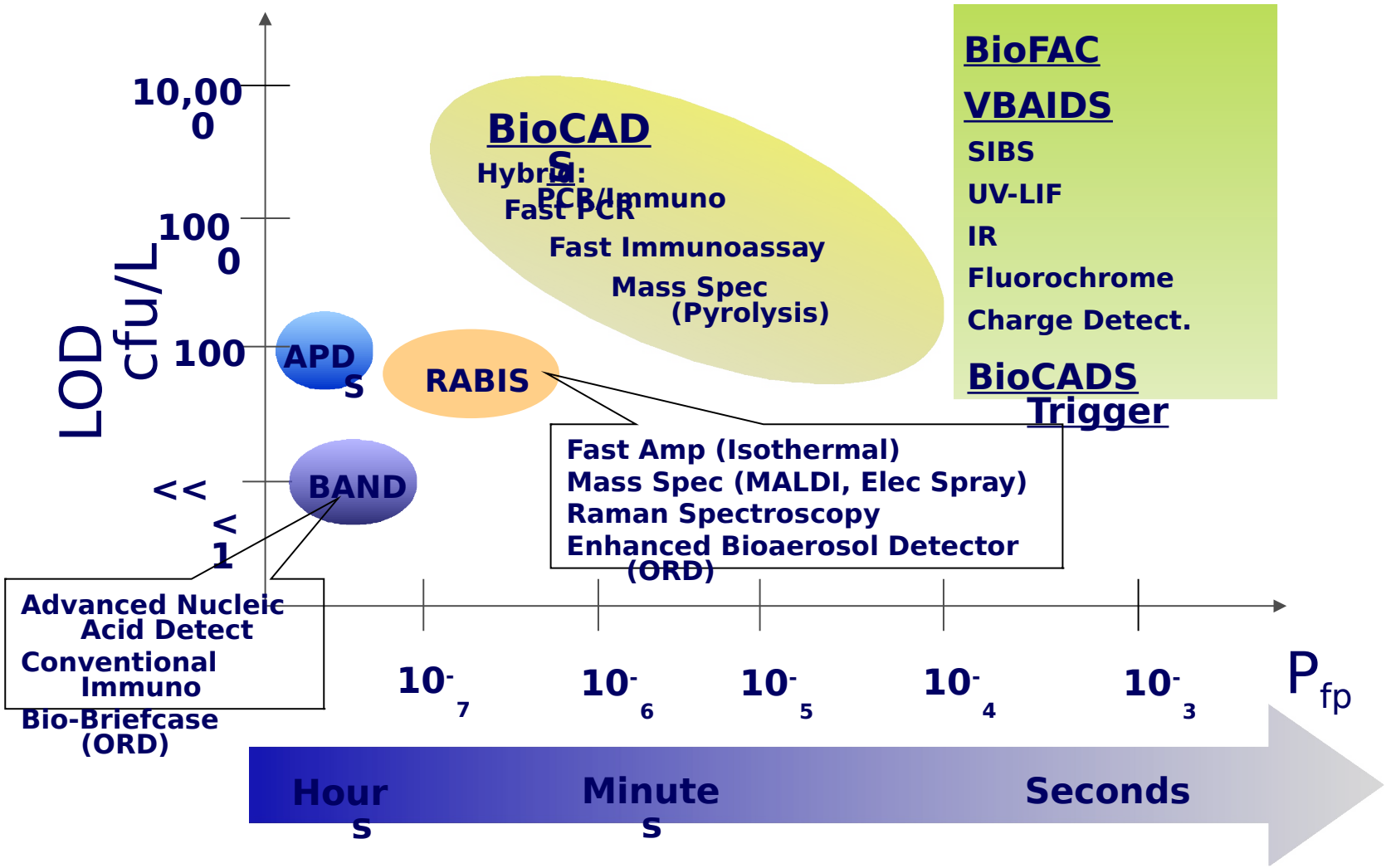
Bio-countermeasure Sensor Strategy



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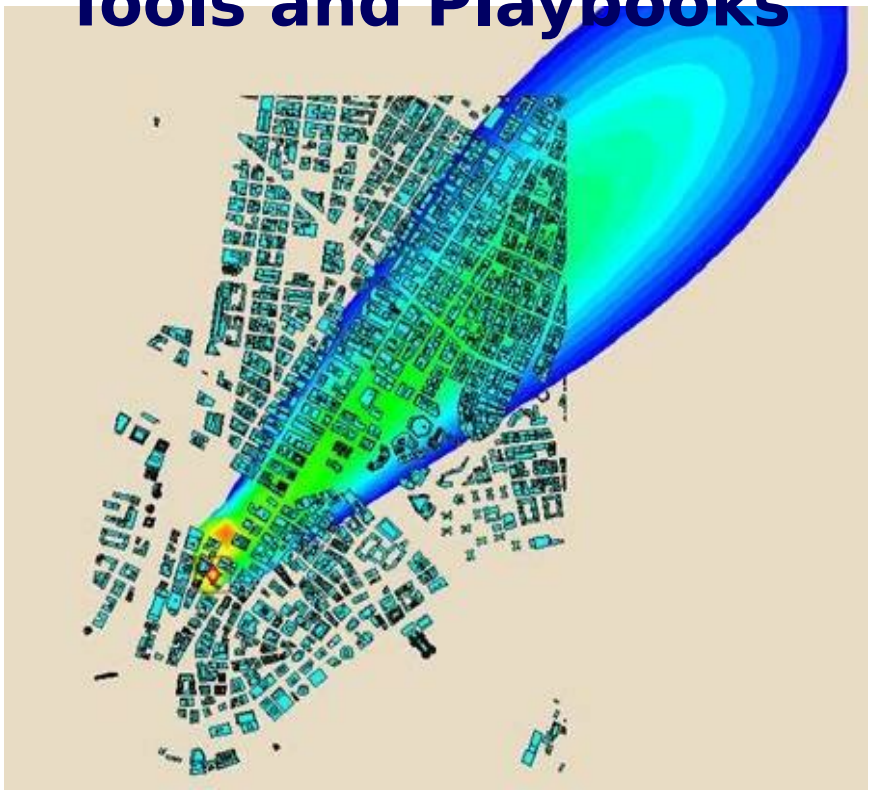
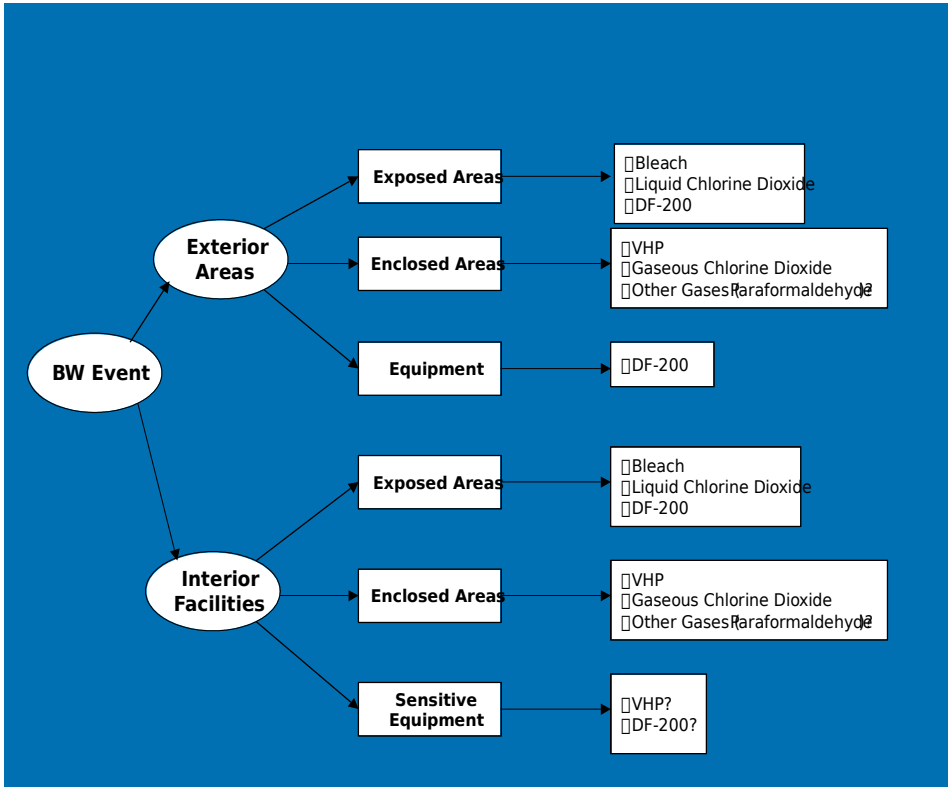
Respond and Recover

Incident Characterization Tools and Playbooks



Systems Approach to Urban Decontamination



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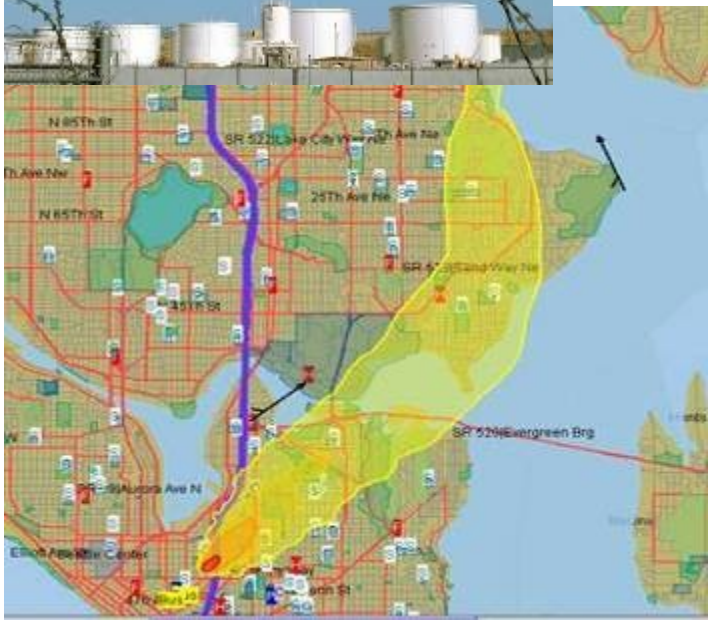
Chemical Countermeasures Portfolio



Mission Statement

Enhance and coordinate the nation's capability to anticipate, prevent, protect, respond to and recover from chemical threat attacks through innovative research, development, and transitions of capabilities.

Objectives

- **Develop national chemical defense architecture**
- **Enhance rapid recovery from chemical attacks**
- **Develop pre-event assessment, discovery, and interdiction capabilities for chemical threats**
- **Minimize loss of life and economic impact from chemical attack**
- **Enhance the capability to identify chemical attack sources**

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Some Guiding Principles

- **DHS program addresses non-medical challenges**
- **Strive to engage the interagency in developing strategy**
- **Strive to utilize existing infrastructure**
  - **Recognize DoD "specialties" in this area**
- **Technology demos will down-select from all potential technology candidates**

Critical Enablers

Binding interagency agreements

Definition of agency roles/responsibilities

Security classification guidance

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Chemical Threats

- **Chemical warfare agents (CWAs)**
  - Mustard (HD)
  - Nerve agents (G, V)
  - Have seen previous terrorist use (Aum Shinrikyo)
- **Toxic industrial chemicals (TICs)**
  - Large array of materials
  - Reasonably accessible
  - Accidents have caused numerous casualties (Bhopal)
- **Non-traditional agents (NTAs)**
  - Not TICs

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Program Structural Elements

Analysis: Program activities which provide fundamental knowledge that shapes problem understanding

Architectures: * System studies to define problem and outline potential solutions
* Operational technology demonstrations

Detection: Programs which develop and demonstrate solutions to promote situational awareness

Response/Recovery: Programs which develop solutions to enhance return to normal state

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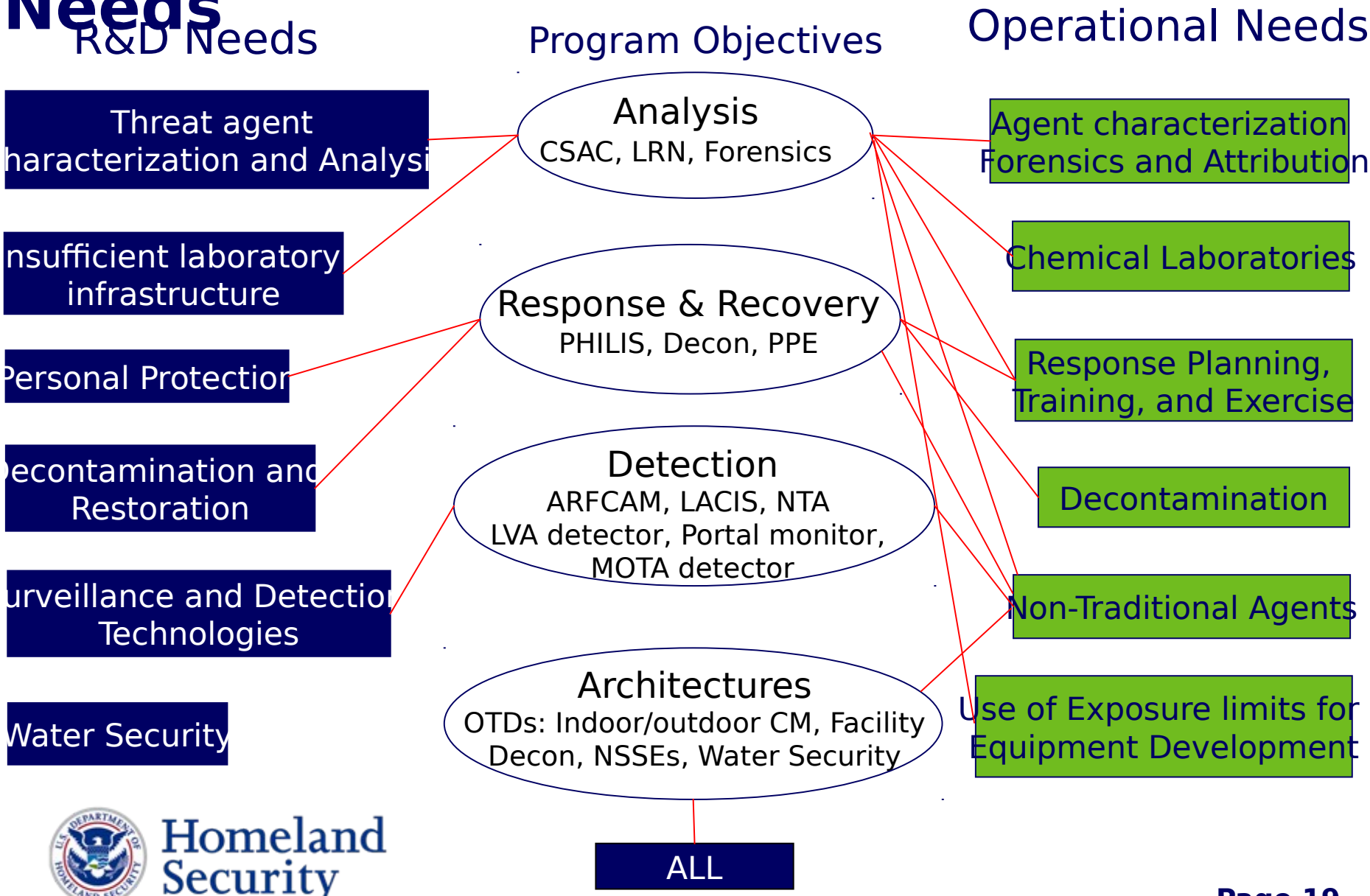
Linkage of Program Objectives to Needs



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Program Area Projects

Analysis

Chemical Security Analysis Center

Forensics

Laboratory Response Network

Detection

Rapid Facility Monitor (ARFCAM)

Hand-held detector (LACIS)

LVA Surface Contamination Monitor

Architecture

Indoor Countermeasures Study

Outdoor Countermeasures Study

Facility Decontamination OTD

NSSEs Deployable Systems OTD

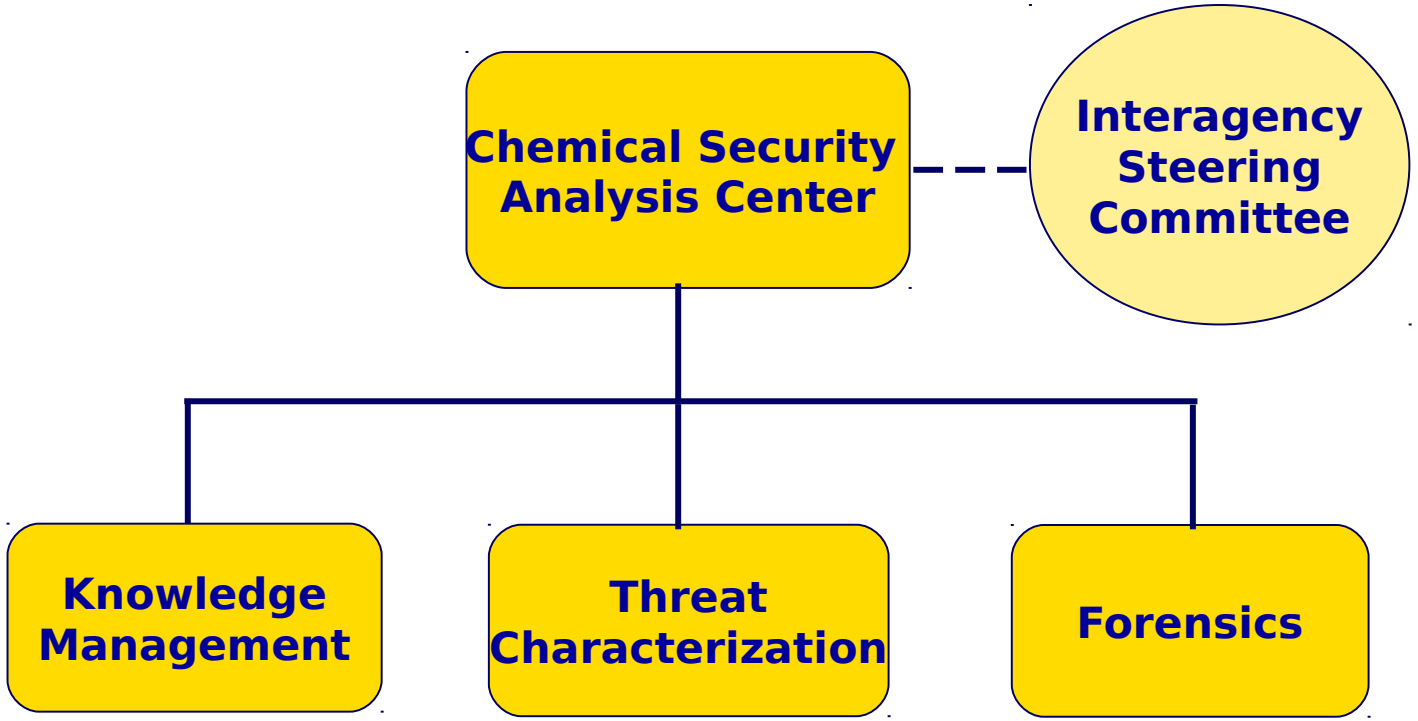
Water Security OTD

Response & Recovery

Mobile Lab (PHILIS)

Personal Protective Equipment Decontamination

Analysis - Chemical Security Analysis Center



- Threat info
- Expert analysis
- Reach-back

- Properties
- Toxicology data
- Agent Fate data

- Attribution determination
- sigs, protocols, & analysis
- Support participant labs

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Analysis - Chemical Environmental Lab Response Network

Description:

- *Organized process for the sampling and analysis* of very large numbers of environmental samples containing highly toxic chemicals.
- The CLRN will be populated by laboratories qualified by an *interagency-agreed accreditation* process.
- CLRN will include *triage laboratories for analysis of unknown samples* potentially containing highly toxic chemicals such as classical chemical agents.
- Support incident response through rapid analysis of samples from chemical release events as well as potentially toxic samples of suspect origin.

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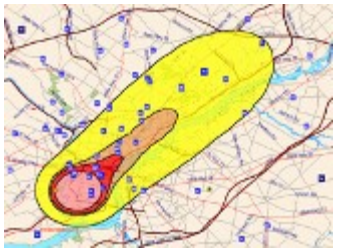
Architecture - Systems Studies

- ***Initial Focus***
  - Top-level risk and consequence assessments
  - Broad range of chemical agents [CW, TIC/TIM, Low-volatility Agents (LVA)]

- ***Studies will provide***
  - Matrix of impacts
  - Assessment of current, available technologies to detect & recover

- ***Studies will be used to***
  - Guide program prioritization
  - Establish functional requirements for technology & systems
  - Develop defensive system objectives
  - Develop performance metrics



Large Outdoor TIC Release

Water Supply Contam

Indoor Release

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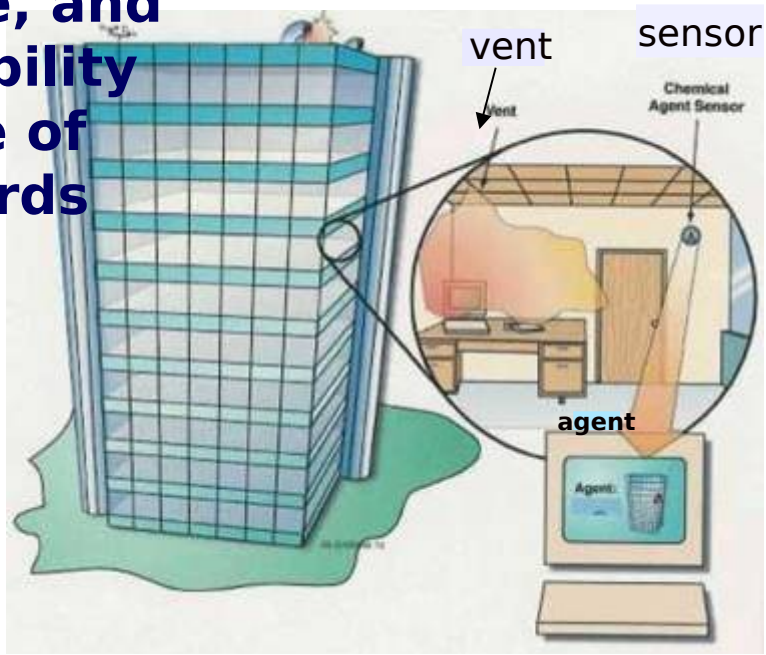
Detection - Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)

***Objective*: Develop, demonstrate, and commercialize a networked capability to detect, and notify of, presence of up to twenty toxic chemical hazards for facility protection**



Challenges:

- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range*: IDLH to PEL
- *Speed:* target 15 sec (IDLH) / 15 min (PEL)
- *System cost*

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Detection - Lightweight Autonomous Chemical Identification System (LACIS)

***Objective*: Develop, demonstrate, commercialize a networked respor capability to detect and quantitate up to twenty toxic chemical hazar to assess a scene for contaminatic and provide guidance on PPE use**

Challenges:

- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range*
- *Adequate performance in hand-held*
- *System cost*

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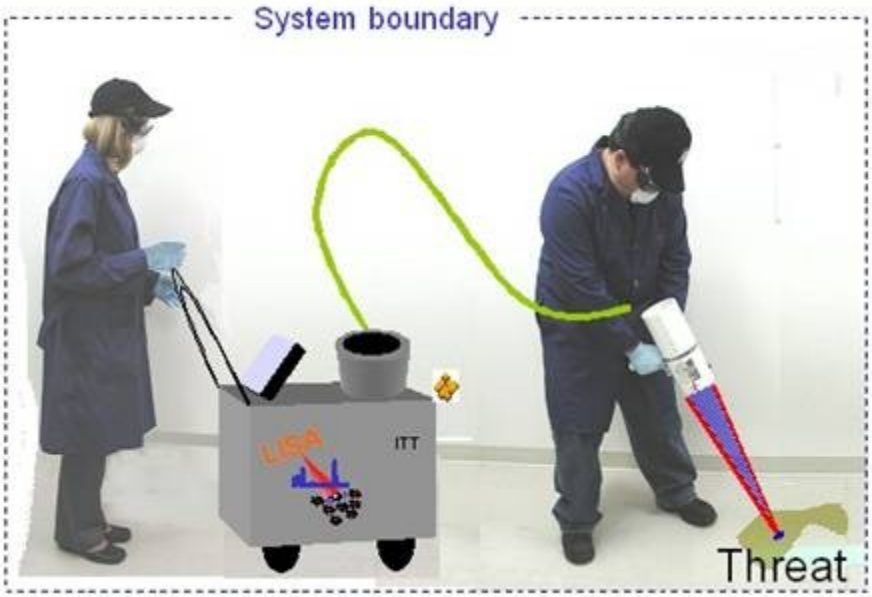
Detection - Low Volatility Agent Surface Contamination Monitor

***Objective*: Develop, demonstrate, and field a transportable capability to detect the presence of highly persistent chemical agent**



Challenges:

- *Selectivity* against surface backgrounds
- *Sensitivity*
- *Area analysis speed*

We anticipate initiating a program to develop sensor for warning of LVA dissemination in FY06

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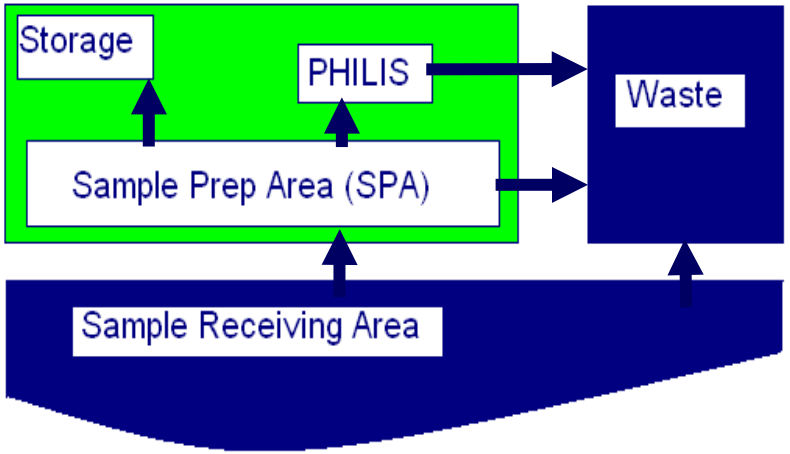
Response & Recovery - Portable High-throughput Integrated Laboratory ID System

***Objective*: Develop, demonstrate, and field a rapidly deployable capability for high-throughput analysis of environmental samples to assess scene of contaminated area and facilitate restoration**

Challenges:

- *Sample load management*
- *Broad set of background matrices*



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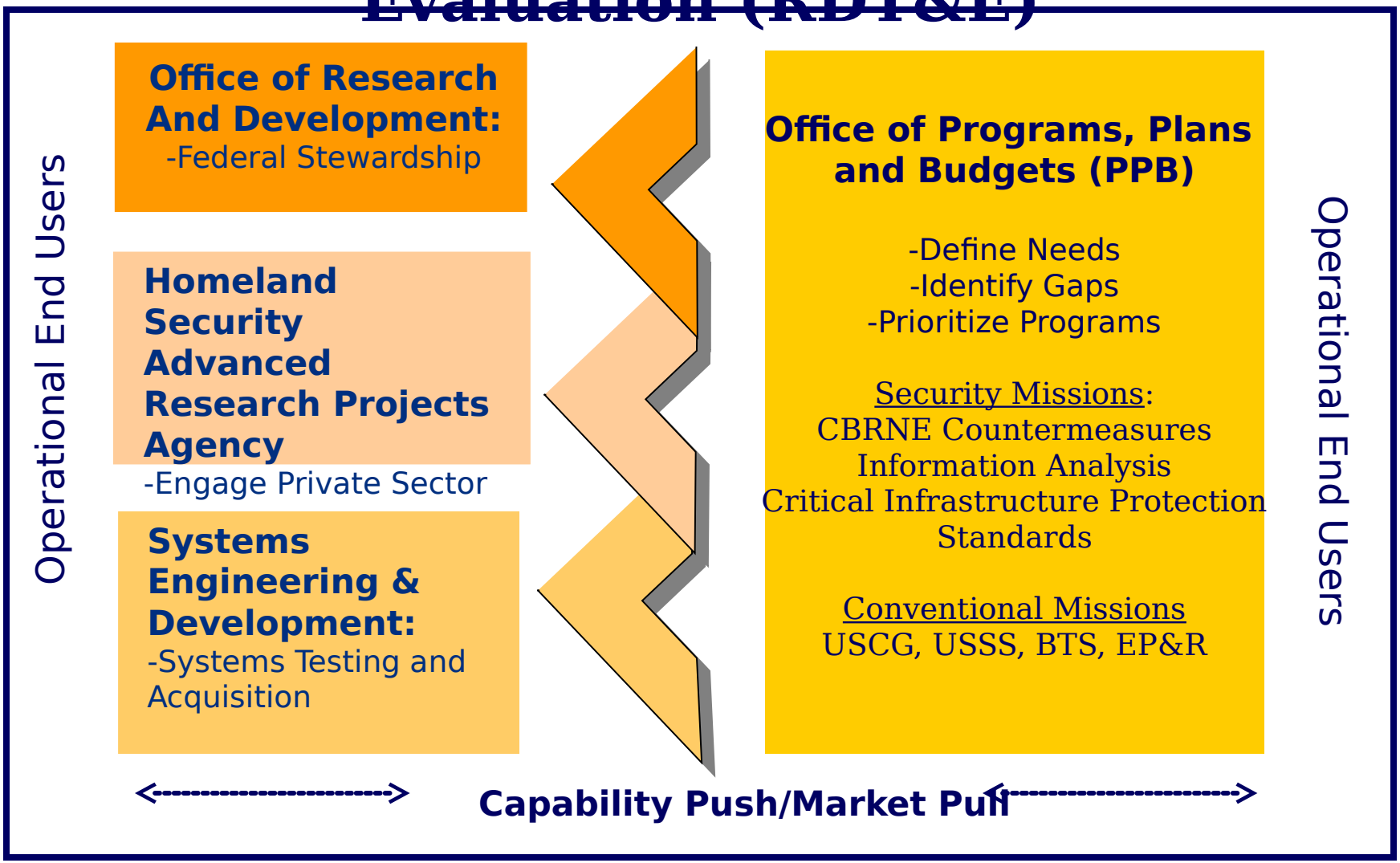
Research, Development, Testing and Evaluation (RDT&E)



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HSARPA Solicitations

Past BAA:

- Detection systems for bio & chem countermeasures
- Bio-informatics & assay development

Current BAAs:

- Instantaneous bioaerosol detector systems (IBADS)
- Food Biological Agent Detection Sensor (FBADS)

Past SBIR solicitations:

- Chem-bio sensors employing novel receptor scaffolds
- Advanced low cost aerosol collectors for surv & …

For more information see www.hsarpabaa.com

U.S. DEPARTMENT OF
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Rapid Automated Biological ID System (RABIS)

- **Continuous, Fully Autonomous Operation with 2 Minute or Shorter Sample Intervals Including Latency**
  - **~250K Samples per Year**
- **Broad Agent Coverage > 20 Agents**
  - **Spore, Vegetative Cell, Toxin, DNA Virus, RNA Virus**
- **Limit of Detection (LOD) of 100 Organisms per Liter of Air**
  - **LOD of 0.05 nanograms per Liter of Air for Toxins**
- **System False Alarm Rate of No More than Once per Month**
  - **Goal to Reduce System False Alarm Rate < 1 Year**
- **Cost of Ownership**

  - Acquisition cost (quantities of 100) of ≤ $50K/unit

  - Operation costs of ≤ $20K/yr (maint., parts, consumables)

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Instantaneous Bio-Aerosol Detector Systems (IBADS)

- ***TTA-1: Biological Fast Aerosol Countermeasure System (BioFACS)***
  - Extremely low cost system for the nearly instantaneous detection of biological aerosols at higher level of detection

- ***TTA-2: Biological Confirmation and Detection System (BioCADS)***
  - Integrated trigger-confirmation capability that will have extremely low cost of operation

- ***TTA-3: Volumetric Bio-Aerosol Detection Systems (VBAIDS)***
  - Volumetric bio-aerosol sensors capable of monitoring large indoor and semi-enclosed outdoor spaces

TTA -1 & TTA-2 are higher priority, TTA-3 subject to availability of fund.

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Instantaneous Bio-Aerosol Detector Systems (IBADS)

BioFACS

- Trigger < 1 min, goal of 15 seconds
- Acquisition cost target of < $10K, with <$1000 as an optimal goal in quantities of 1,000

BioCADS

- 5 min or less for confirmation, trigger speed is goal
- Acquisition cost target of < $25K, with <$1000 as an optimal goal in quantities of 1,000

VBAIDS

- trigger <2-3 min, goal <1 min
- Acquisition cost target of < $50K, with low O&M costs

All- ROC curves for

- 1000, 10,000 and 100,000 CFU(PFU)/Liter of air (Spores, vegetative bacteria, RNA and DNA Viruses)
- 0.5, 5 and 50 ng/Liter of air for toxins

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